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Computer generated surface design and structural weave

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COMPUTER GENERATED
SURFACE DESIGN AND STRUCTURAL WEAVE

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CHAPTER 1.

INTRODUCTION

"Computer Generated Structural Weave And Surface Design," the title itself is immensely broad and covers a very large area of study. The question asked at the beginning of this search was "What are the possibilities for textile design/fiber art as far as the computer is concerned?" During the course of graduate school education, opportunities presented themselves to work on many different computer systems. Experimentation and creation of fiber art or surface design patterns have been produced on the Apple IIe, Artronic, Genigraphic, IBM. and Macintosh computers. Structural weave fiber art pieces have been designed on the Apple/AVL computer loom system and the Atari/Macomber computer loom system.

The techniques that have been used to translate computer designs are many and varied, so due to obvious space limitations it will be assumed that the reader of this thesis has basic knowledge of textile design and techniques. Also, due to the large amount of

computer systems and programs that have been experimented on, detailed information on the operation and commands of various computer systems and programs can be found in the appropriate manuals. The primary focus will be on the computer system used, the negative and positive aspects as far as fiber art/textile design are concerned, the method of translation of the design into various textile techniques chosen.

The thesis will begin with an explanation of the preliminary experimentation completed on different computer systems leading up to the main thesis work. This is an absolute necessity due to the lack of published research in this area of study. These sections will be organized by work by surface design, structural design and a combination of the two.

It must be mentioned that surface design is considered to mean anything other than an actual structural weave. The computer system used will be discussed and the translation technique used to convert the design into textiles. Personal reasons for choosing the theme of this thesis "Woman: Inside and Outside," will be explained. The decision to choose this theme has deep personal meaning and was decided after much meditation, an explanation is also needed as to personal feelings and observations about creativity and design.

At this point, the actual creative process and technique

involved in completing each of five thesis works will be detailed. This will be followed by a troubleshooting section for the Atari/Macomber computer loom system. This section most definitely will be of assistance to future students.

Research was difficult due to the newness of the subject chosen. The published information discovered will be shared, plus the results of a questionare that was created and mailed out to two hundred textile companies and two hundred textile designers.

The completion of this thesis has led to many discoveries and conclusions, it has also opened up new paths and roads to take in continuing research and experiments on this subject. This thesis will end with a discussion of conclusions and plans for future study.

PART I.

PRELIMINARY STUDIES OF COMPUTER GENERATED STRUCTURAL WEAVE AND SURFACE DESIGN AT ROCHESTER INSTITUTE OF TECHNOLOGY

CHAPTER 2.

SURFACE DESIGN

The first two computer generated surface images were designed on the Apple IIe computer, using the Koala Paint program. The resolution is not the best, in other words the pixels are large but that can be an asset, depending on the results and type of design desired. A drawback is that in order to do any editing such as cut and paste and print-outs, the image has to be moved into the Graphic Illustrator program. In order to have a finished printed image, two programs must be used. These completed images were either print-outs on the color Imagewriter or slides shot directly from a screen.

The scarf image (Fig. 1.) was generated on the Apple IIe with the Computer-Eye program (Fig. 2.). This program allows the user to attach a video camera to the Apple computer and capture various images, the user then has the option of moving these images into several paint programs. A black and white captured image of myself was created as the design, a few minor changes were made to it in Koala Paint, and a print out was attained in the Graphic Illustrator.

Fig. 1 Frenchdyed silk scarf

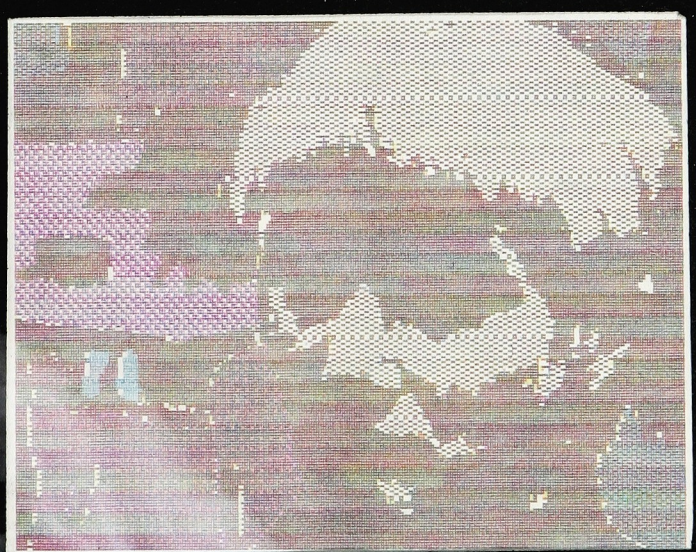


Fig. 2 Imagewriter print-out of Computer-Eye image

Fig. 3 French-dyed silk scarf

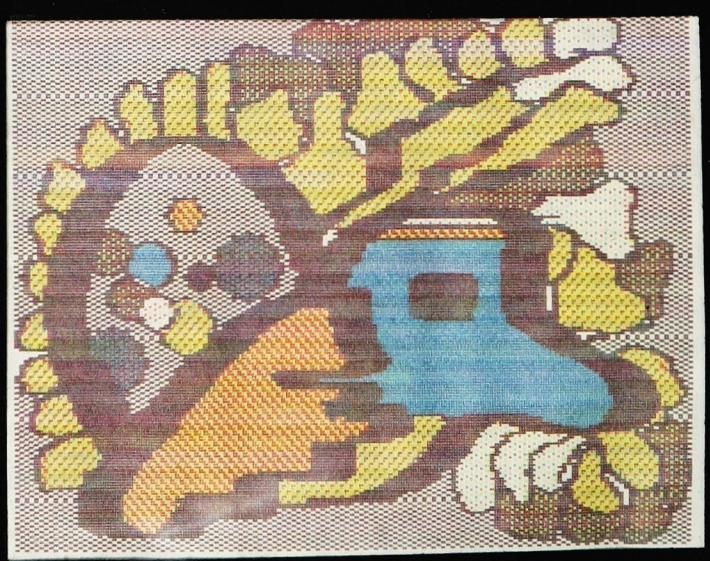


Fig. 4. Imagewriter print-out of Koala Painter design

Three different programs have been used to get to the finished image, this is time consuming. As one advances into more sophisticated equipment, expectations are higher and the patience level for using previous equipment decreases.

From the completed print-out, it proceeds with drawing it out to size, tracing the image with a fabric pen, applying gutta resist and painting the areas. This scarf was completed by lightly airbrushing in the background with light colors.

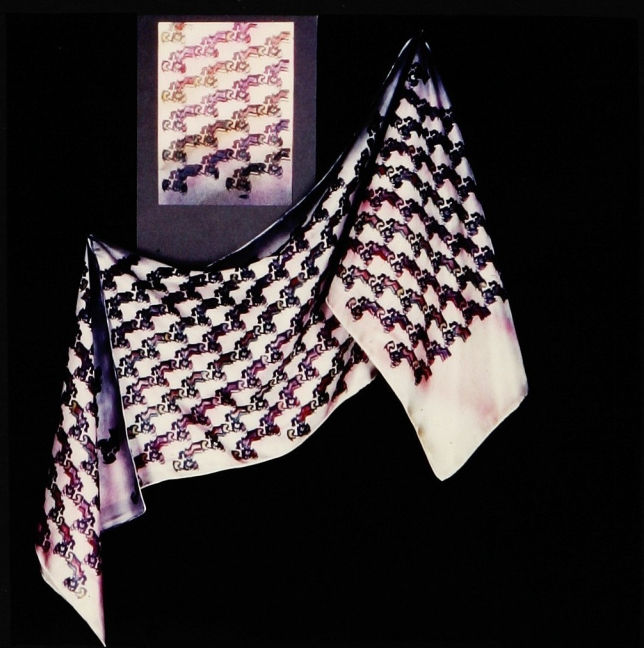
A color print-out from the Koala Paint program was used in producing a design for the French dyed silk scarf (Fig. 3). The print-out image (Fig. 4.) was graphed and blown up to the scarf size and then drawn out on white paper. This paper cartoon was placed on the light table, and the silk scarf was stretched on a wood frame directly over it. The cartoon was traced onto the scarf with a fabric pen. The frame was moved to another area and gutta resist was applied over the fabric pen lines, onto the fabric. The areas were then painted in with French dyes.

The Apple computer system and the Computer-Eye and Dazzle Draw programs were used to design the imagery for a three by four foot tapestry created using handspun wools (Fig. 5.). An image of a girl was grabbed using a video camera and the Computer-Eye program. The higher resolution option was chosen and the image was moved into the Dazzle Draw program. This is a fun program to work

Fig. 5. Handspun tapestry

Fig. 6. Imagewriter print-out using Computer-Eye and Dazzle Draw programs.

Fig 7. Silk screened scarves designed on the Macintosh Superpaint program



with on the Apple system. It combines the best points of the Koala Paint and Graphic Illustrator, plus the resolution is much higher, and it enables the user to achieve finer detail, if that's what is desired. Sections of the image were repeated, inverted and air-brushed in colors to create a design for the tapestry. It was printed out on a color Imagewriter (Fig. 6.) and an overhead projector was used to reproduce the design and cartoon. The resulting cartoon was placed behind the tapestry warp. These programs were fun to work with and the method of translation into fiber was relatively easy. More experimentation with these programs are planned for the future.

Two additional scarves were designed on the Macintosh computer system using the SuperPaint program (Fig. 7.). This program enables the user to create several repeat designs which can be printed out to create an instant croque which can be painted and airbrushed. The design was enlarged to 10"X14" on the Ready,Set,Go program, and film positives were made directly from the computer print-outs. From these positives, screens were sensitised and developed, the two printed silk scarves shown in the examples were the results. French dyes along with alginate was used for screening. The results were excellent, with more research and experiments using the Macintosh computer system are being planned. Only the surface has been touched as to the possibilities of this system, with more exploration time, possibilities are unlimited.

Fig. 8. Silk screened fabrics designed on the IBM Megacadd program

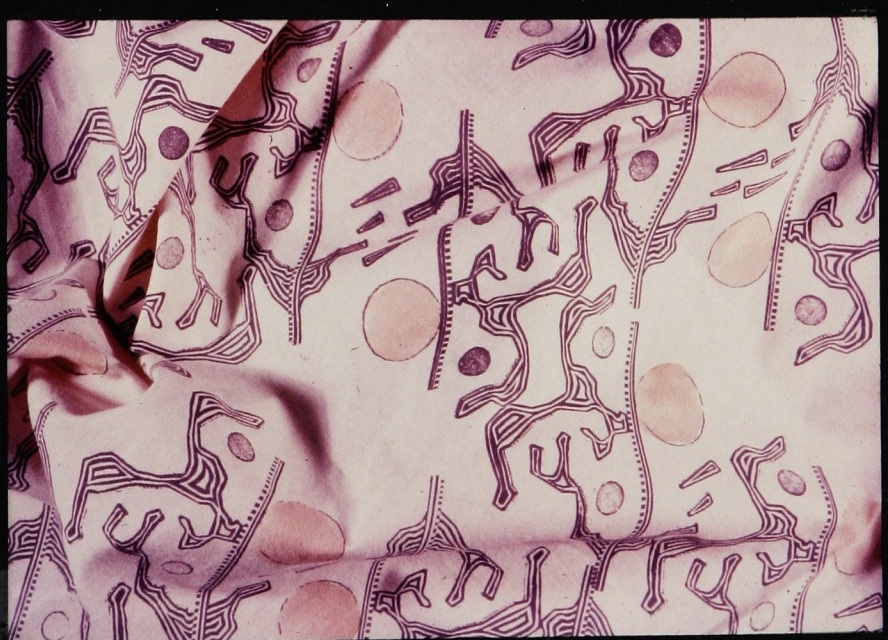


Fig. 9 Feather image designed on the Artronics Paint program

Fig. 10. Feather image translated into textiles

A course on the IBM Megacadd was being taken during the same time period as the surface design class,so naturally, curiosity arose as to the possibility of translating MegaCadd designs on to fabric. First, an image was developed on the MegaCadd, an interesting view point was found, (on this program you can set a view point 360 degrees around an object) and than the image is plotted. The plotted image was then copied and reduced into several sizes. These images were arranged into a design for the silk screen process. Two other images completed this way were used for several scarves and fabric yardage (Fig. 8.). It was fun designing on the MegaCadd program for silk screen, but for actual surface design work it proved impractical, because of limitations in design possibilities. Its real value would be for designing 3 dimensional architectural fiber works.

The Artronics computer system has a paint program which was fascinating enough to warrant two quarters of study. One of the images created was that of a bird that had been grabbed by way of a video camera into the program, from that point, the body of the bird was eliminated. The wings of the bird were then copied, stretched, compressed and rotated. The resulting image is reminiscent of a beautiful feathery flower, (Fig. 9.) and this image was used to create two mirror image transparencies and were designed to fit into the windows of an entrance hall (Fig. 10.). Duringthe Artronics class,

Fig. 11. Croque and fashion image designed on Artronics computer system

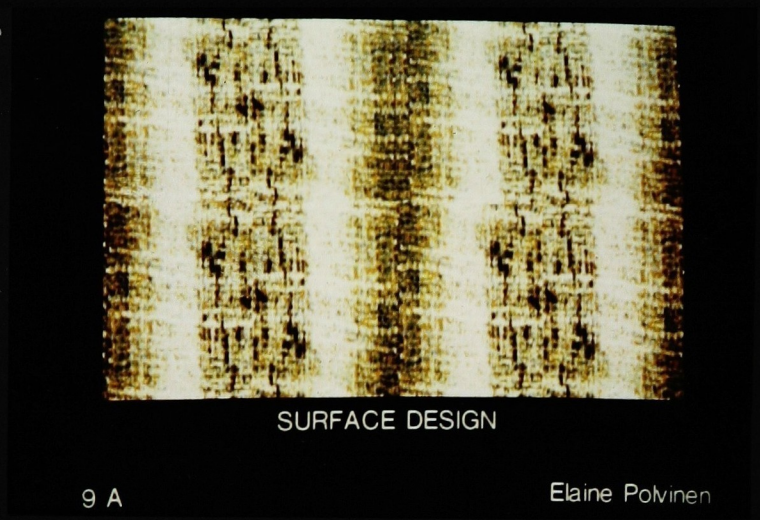


Fig. 12. Croque and fashion image designed on Artronics computer system

the only method of attaining finished images was to produce slides directly from the screen. The slide was then projected onto a wall, very small, it was traced on to a paper than placed into the overhead projector and projected to the proper finished size for the transparency. The reason for choosing this method is rather unclear, it would have been easier to project the slide to the completed size needed. The Artronics images were fun to work with and many options were available, but the computer system itself is to expensive and the only output is mainly for slides.

A little experimentation was also accomplished at this period, with video grabbing actual textiles, manipulating the image and converting it into a repeat design. Fashion images were fed into the computer, and a masking technique was used to place a repeat design onto clothing (Fig 11.-12.). The various possibilities of using this computer system as a tool for surface designers presented itself, but after ten weeks of experimentation on the Artronics program it was concluded that the negative points outweigh the positive ones as far as textile design applications are concerned.

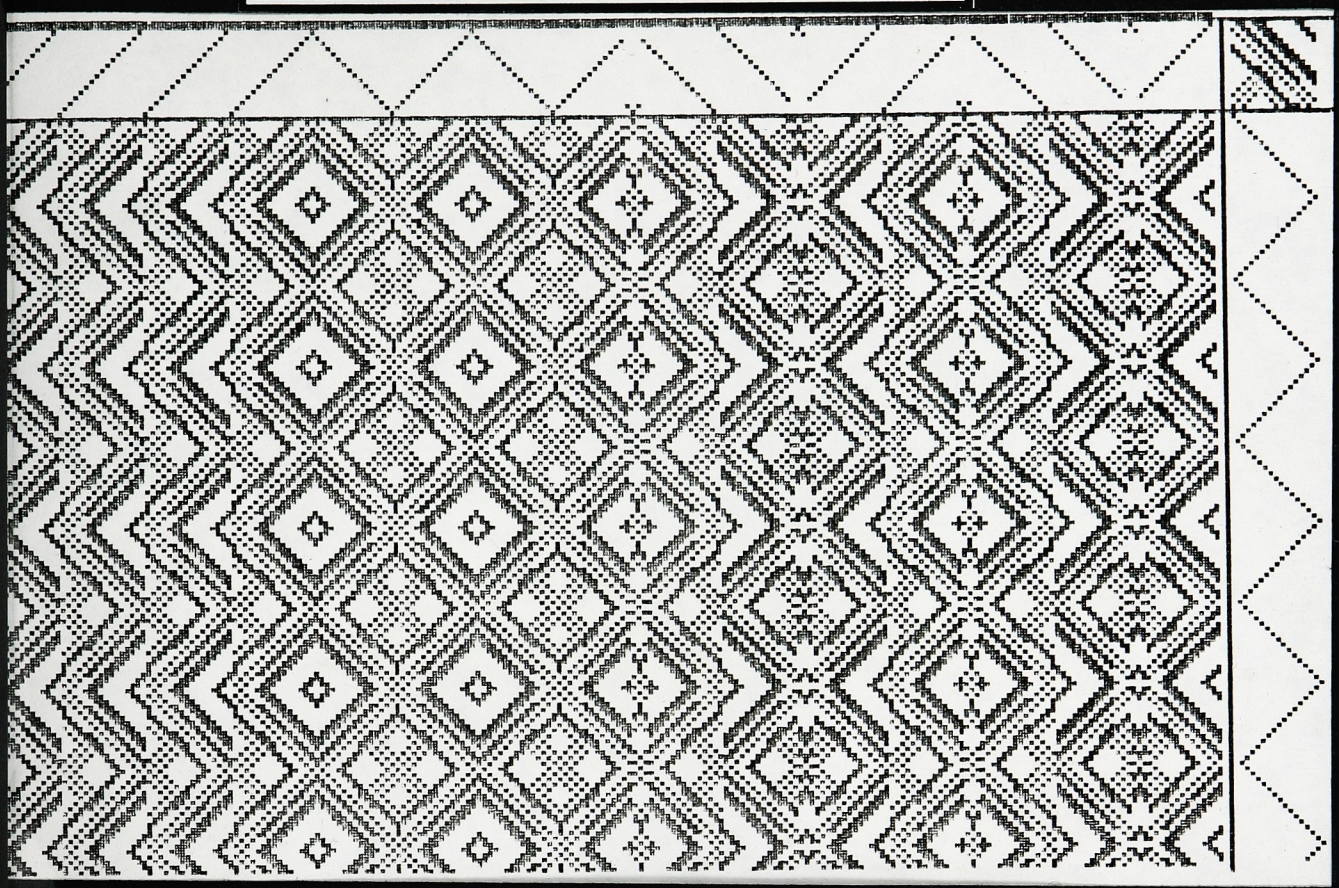
CHAPTER 3

STRUCTURAL WEAVE

Studies began with the artistic possibilities available through computer designing and weaving, a series of twenty-four fabric samples designed and woven using the Atari/Macomber computer loom and the Weavemaster program (Fig.14.). These samples were woven with a combination threading of a straight draw and a point twill. Much was learned about the concept of designing on the computer and seeing it develop into a fabric sample. Weaving a long sample warp is the perfect way to become forever "addicted" to computer designing and weaving. The last one third of the warp consisted of experiments with waffle weave designs and painted warps. If there is ever one beginning point for a perspective student of computer designing and weaving this is it.

The idea for the wool waffle weave piece titled "Feelings" (Fig. 17.) came from the sample selection of waffle weave patterns. The warp was a heavy handspun wool, which necessitated the use of string heddles with large eyes, the sett was 4 E.P.I.. After the piece was designed and woven on the Atari/Macomber computer loom

Fig. 13. Print-out from Apple Design and Weave program



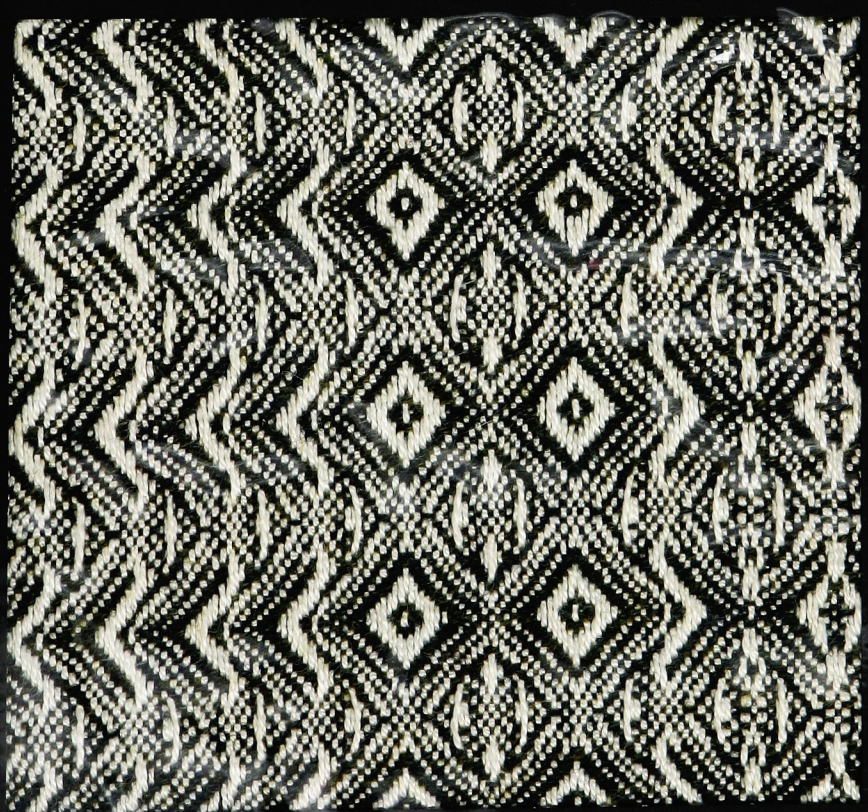


Fig. 14. Sample of above print-out woven on Atari/Macomber loom

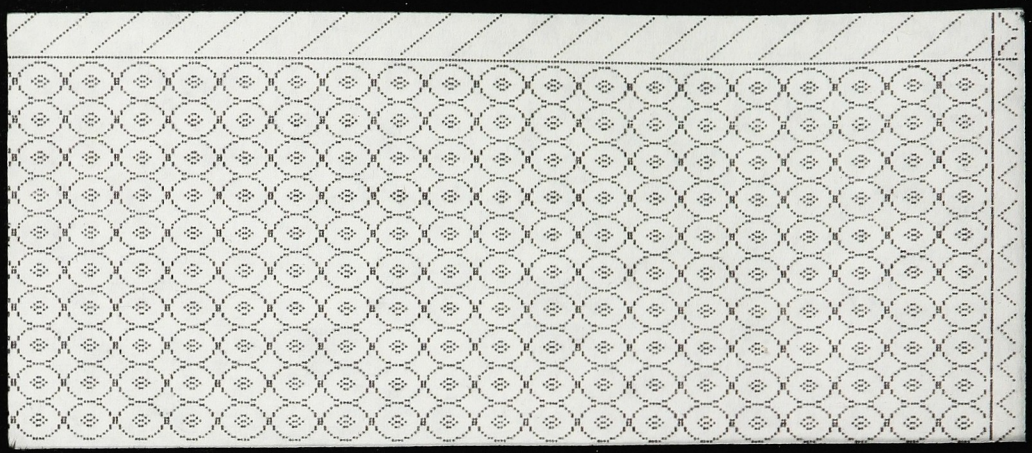


Fig. 15. Print-out from Atari/Weavemaster program

Fig. 16 Silk painted warp woven with above pattern on Atari/Macomber loom

system, all the loose floats were sewn into shapes. The entire piece was then air-brushed using Lumunare fabric paints. These paints were extremely difficult to air-brush with because they kept clogging in the needle. It was then steamed to set the paint and mounted on a natural wool fabric background with a plexiglass shadowbox covering the entire piece.

The piece titled simply "Color Study" (Fig.18.) was an extension of waffle weave designing on the Weavemaster program. It consisted of a heavy rayon rope warp and weft which was than stretched over a frame and air-brushed with fabric paint. The results of using the rayon were not anywhere near the pleasing results of the wool in the previous piece.The type of materials chosen to weave with is very difficult to envision with computer drawdowns, however the Atari Weavemaster does allow for thick and thin warp ends and even allows for spaces in the denting. This is a very positive point regarding this program.

The Apple/ AVL computer loom system was what was used to design the multi-layer piece pictured (Fig.19.). It was designed with the Generation II program, using multi-layer color study involving eight separate layers of fabric. The biggest difficulty with this program is that it is not possible to design in color. It is difficult to envision the final design. This is where the Atari Weavemaster is superior to this program, it enables the user to see the color thread

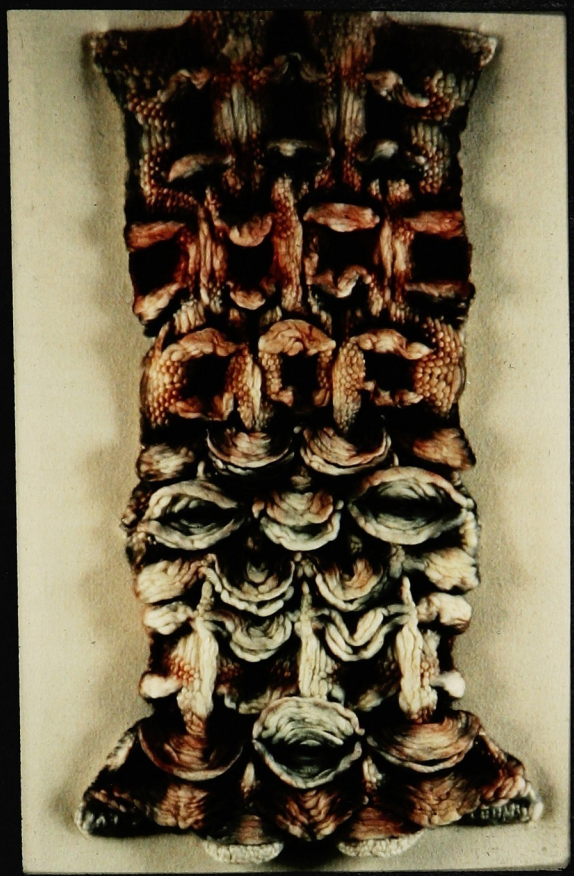


Fig 17. "Feelings" designed and woven on Atari/Macomber computer loom

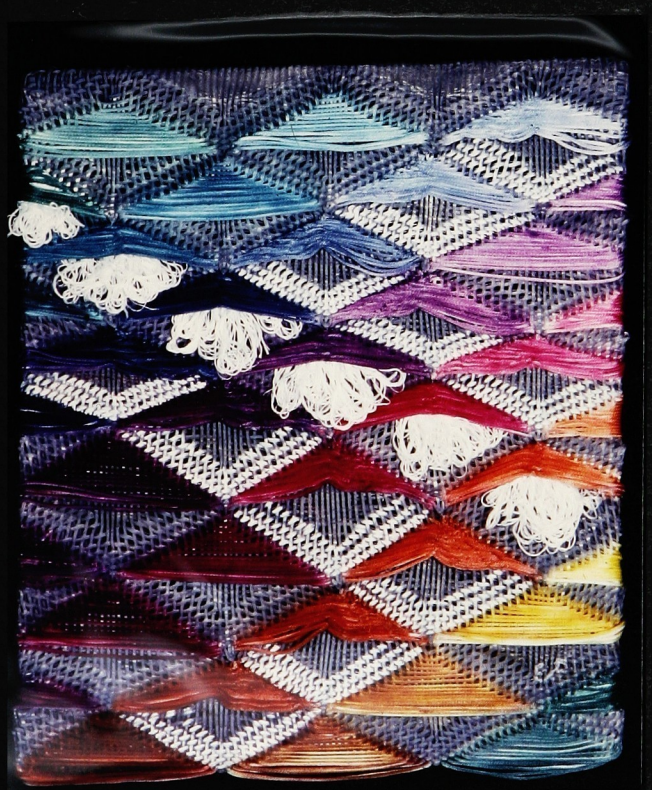


Fig. 18. 'Color Study," designed and woven on Atari/Macomber computer loom

Fig. 19. Multi-layer, designed and woven on Apple/AVL computer loom

Fig. 20. "Come Fly With Me," designed and woven on Atari/Macomber computer loom

by thread and the front and the back of the fabric can be viewed.

"Come Fly With Me" (Fig.20.) is the title of the first of a series of three pieces which were created and led directly into the thesis work. Soft spun silk was used for the warp which was sett 48 E.P.I., 24 inches wide. The front of the warp was pulled straight out and clamped to a table. The torn paper design was then placed onto the horizontal warp with temporary bonding spray. Both sides were then air-brushed using French dyes. It was wound back on to the loom and woven with an overall warp faced design that was created on the Atari Weavemaster.

CHAPTER 4.

COMBINATION OF STRUCTURE AND SURFACE DESIGN

The next piece is the second in a series of three experiments that directly preceded the actual thesis. With each piece a foundation of knowledge was built upon about designing structure and surface imagery on the computer. In the first piece "Come Fly With Me," computer use was limited to structure only because technique had be learned as far as painting the warp was concerned. Knowledge has to be built upon slowly and steadily with a continuous foreward advancement. To immediately jump in over your head is an unwise set-up for failure, one must experiment.

The goals increased for the second piece to include transferring a surface image that was designed on the Artronic computer system. What began as an exercise in technique turned out to become a stitchery,"The Secret Space Where I Create" (Fig.22.). It began with the desire to translate an Artronics image from a slide (Fig.21) onto the warp which was then airbrushed and woven with a structure pattern from the Weavemaster program. A slide was projected onto the wall to the size desired for the warp, 24" X 30."

The image was then traced on to white paper and placed on the light table in order to make a second copy. Two copies of every shape were cut out and temporary adhesive was sprayed on it to make a paper frisket. As in the first piece, the warp was pulled out forward and clamped to a table. The warp was horizontal while being worked on, which made it very difficult. The thought of working this way on the large pieces planned was frightening. Both sides of the warp were airbrushed in order to achieve maximum coverage. French dyes were used so a respirator was mandatory, but working under the warp was impractical and unpleasant. Eye protection would also be necessary if this method was to continue. Looking up through the warp toward the ceiling lights also made it difficult to see the colors in airbrushing. The paper friskets worked great and a maximum of coverage was achieved by airbrushing both sides. The image of the woman came out quite well and was woven with an overall pattern that carried the feeling of the lace in her dress.

The figure and patterning were pleasing but the overall design of this piece was disappointing, in short it felt too boring, there was not enough movement. That's why the decision was made to cut the piece up and redesign it into a stitchery. And the outcome was very successful.

Various goals continued to escalate in the third piece. An overall warp-faced structure pattern was designed and woven, a

Fig. 21. Fashion image designed on Artronics computer

Fig. 22. "The Secret Space Where I Create," surface image designed on Artronic system and structure designed and woven on Atari/Macomber computer loom

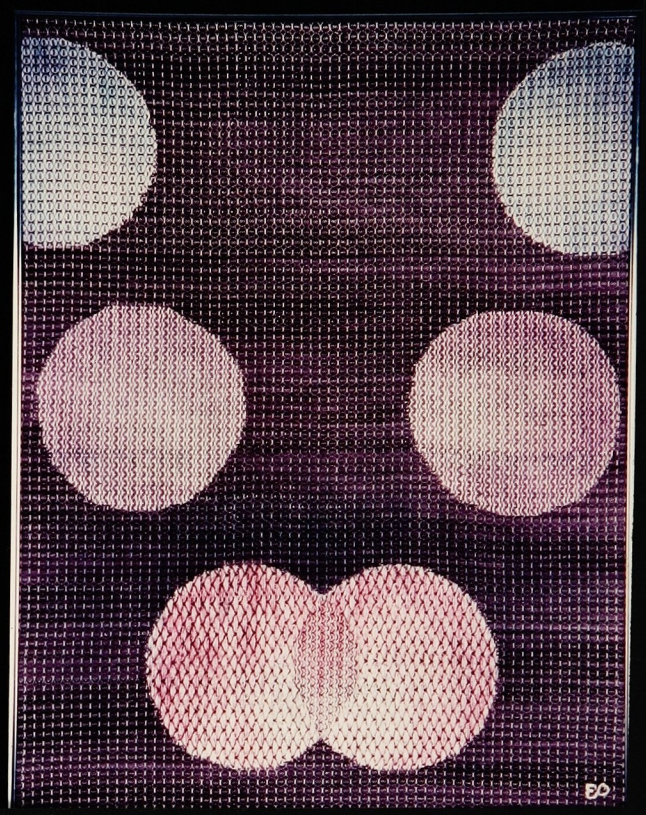
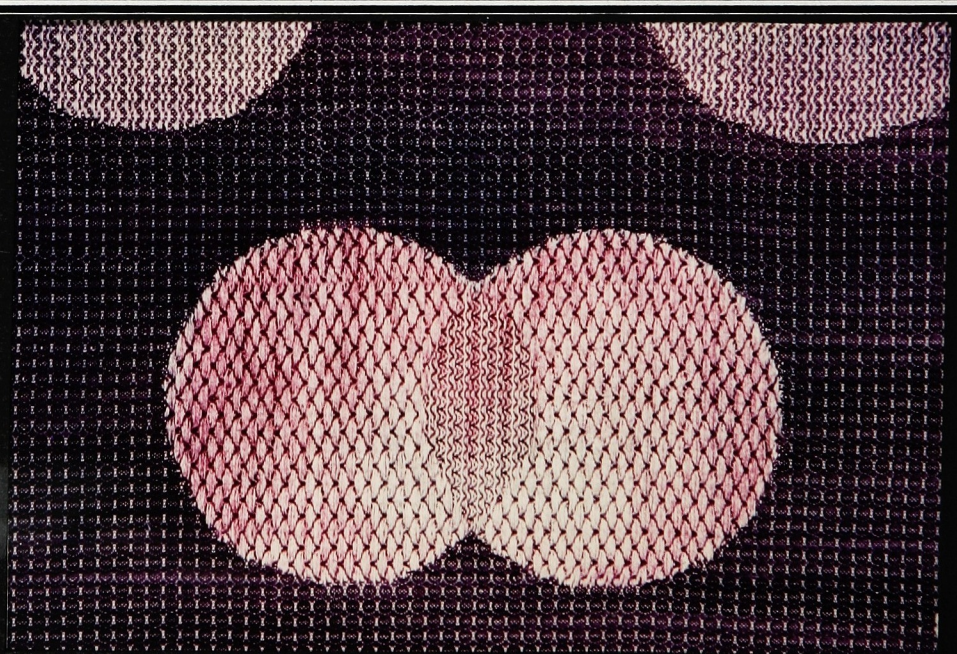


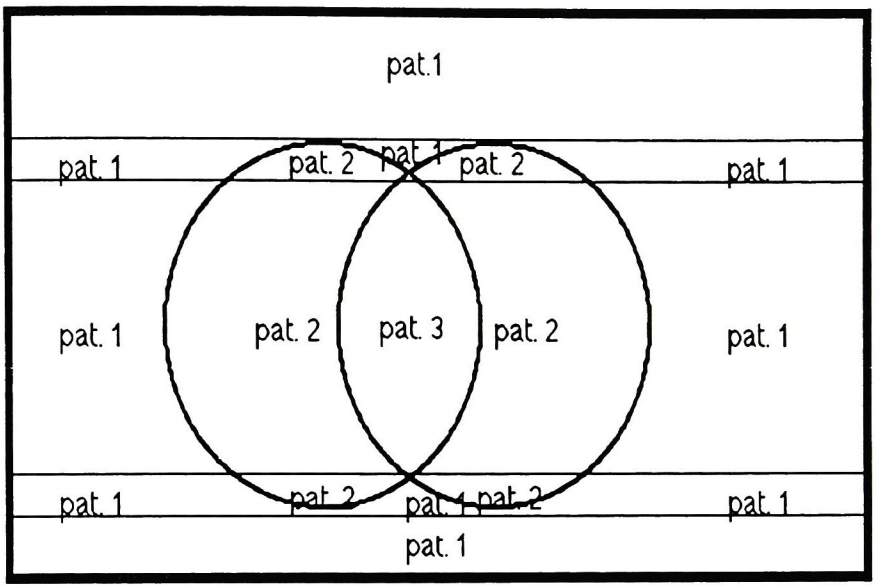
Fig. 23. "Spheres," surface image designed on Genigraphics and structure designed and woven on Atari/Macomber computer loom.



computer generated imagery had been successfully transferred on to the warp, and plans were being formulated to create different patterning which would follow the painted imagery. The piece titled "Spheres," (Fig. 23.) was designed on the shape program from the Genigraphics computer system. The completed computer image is photographed on a PS2000 slide maker. From the slide projected on the wall the image is traced as in the last piece to the size desired. An extra copy was then created and the paper frisket was placed over and under the warp.

The main difference in this piece is that several different structural patterns were manually programed into the computer. The Weavemaster program enables the user to tie up to 64 different treadles. At the point of the two red spheres overlapping, three different weave patterns merged together. In order to move across the shed once, the weaver needs to change the treadling sequence at least five times, (ex. pat.1, pat.2, pat.3, pat.2, pat. 1).

Also when moving on to a different treadling sequence in order to follow the image, (ex. pat.1, pat.2, pat.1, pat.2, pat.1), the weaver has to make sure that each separate treadling pattern follows its correct individual sequence. This piece was the real prototype for the first two figures that were created for the actual thesis.



TREADLING SEQUENCE FOR MERGED PATTERNS

The knowledge and technique about merging patterns was discovered on this piece. Also discovered was the fact that although the soft spun silk was truly beautiful with the French dyes, it could not hold up as a warp. It pilled terribly and could not stand the abuse of being pulled through the heddles and reed. Consideration was given at this point to pulling the back beam out to paint the warp, but the long yardage (12 yards) in the final pieces made this method impractical. Airbrushing on a vertical warp was the goal at this point, and this allowed the warp to be drawn out and dyed.

PART II.

THESIS

CHAPTER 5.

THESIS THEME,"WOMAN INSIDE AND OUTSIDE"

The Earth Mother is a cosmogonic figure, the eternally fruitful source of everything. She is simply The Mother. All things came from her, return to her and are her. The totality of the cosmos is her body, she gives birth to everything from her womb, and she nourishes all from her breasts. There is no essential change or individuation. Each seperate being is a manifestation of her; all things share in her life through an eternal cycle of birth and rebirth.

–ENCYCLOPEDIA BRITANNICA

The theme for this thesis :"Woman Inside And Outside," was chosen after much meditation on the disturbing images of women throughout the history of art. Woman is a fascinating and complex individual, An attempt has been made to focus in on the essence of her being and the intensity of her feelings to create a small portion of the aura of woman.

Admittedly, this disturbance has been recent. There has been a long standing personal awareness of the paternal society we live in and the limitations and restrictions still to this day imposed on women. This awareness surfaced during a class titled, "Women In The Visual Arts," where the focus was on woman as artist and subject. Twenty years ago in a predominately female undergraduate school the total omission of women artists in art history courses never seemed odd or unusual. The questions, "Where are the women artists?" or "Are there any women artists?" were never asked. That is how ingrained the male/superior female/inferior concept was in our society. Extensive reading on womens' issues and the history of men and womens cultural traditions failed to produce a self awareness as far as women as artists and subjects was concerned. This self observation led to the realization of how deeply permeated these attitudes are.

Woman as the subject in art causes distress, the temptress, the seductress, the evil sensuous creature. If she was portrayed as mother, she was devoid of sensuality although creating, giving birth and breastfeeding are all extremely sensual experiences. Sexless or virginal is the way she was portrayed as a mother. Virginal/good or sexual/evil are the messages these images

communicated. Historical research revealed the source of these messages.

The bottom line is power and control. Before Christianity when society was matriarchal all the power and control was in the hands of women. Both the matriarchal and patriarchal systems seem to be equally destructive to personally fulfilling relationships between men and women. Religion in each system seems to have been created to support and enforce the power and control. In the patriarchal system the sexual restrictions and monogamy insured the males knowledge of paternity. The ingrained sexual repressions forced upon society by Christianity caused centuries of unhealthy and destructive emotional and sexual relationships between men and women.

These ingrained attitudes have caused men to view woman as a splintered individual, when in truth she is multi-faceted and ever changing. LIke man, woman is intellectual, emotional, spiritual and sensual. These realizations were the inspiration for "Spirituality: Woman Inside, Her Soul" and "Sensuality: Woman Outside, Her Body." The creative goal in the first image is to discover what was an image throughout the entire history of art that

represented all women spiritually, in other words, their soul. Meditation was short, and specific images that felt warm and good came to mind immediately. The Cycladic figurines in particular have a great deal of mystery connected to them. They are quite different then the earlier fertility figures and their meaning is a mystery to historians. Intuition says that these figures represent the soul of women and because of strong personal attraction, they were chosen.

The images appear simple on the outside, but like the women they represent, they are immensely complicated when you take a second closer look. The subtle patterning changes are fascinating to look at. The color is warm, inviting and enveloping. These simple yet complex forms represent the soul of woman. Gazing at her, she seems to say, " To take a quick look and pass me by tells me a lot about you. Wait, look again, look closer this time, I am complex beyond belief. The more you share yourself with me, the more you will receive and discover about yourself." Here is the core of woman totally stripped of all the exterior surface trappings of learned femininity such as fancy hairdos, colored fingernails, frilly clothes, high heels, painted faces. Even her own sensuality is removed so that the viewer can better feel her.

Sensuality, the freedom and pleasures of hearing, seeing, touching, tasting and smelling. The senses are an exquisite gift of life and to spend most of life repressing them or denying them is very sad. The pleasures of the sensual experiences in life was the inspiration for "Sensuality: Woman Outside, Her Body."

People are realizing that emotional and sensual love are an unbeatable combination and to share them with the person you love is an experience unmatched in life. This observation produced "Ecstasy: Merger of Conscious and Subconscious."

Throughout life we all develop and mature along different channels. We experience different breakthrough points in each of these areas at different points of our lives. When we discover that we are searching, but not quite knowing for what, we must tune into ourselves to find what we have to come to terms with. Self-discovery and self-acceptance of our needs regardless of our religious or cultural background is a positive step towards self-awareness. These thoughts were the inspiration for "Psychological Breakthrough: Intellectually, emotionally, Sensuously and Creatively."

CHAPTER 6.

CREATIVITY AND DESIGN

At the beginning of graduate school, design was a vague concept that was never quite internalized at undergraduate school. Formal answers came easy if someone asked what design was, it is form, space, rhythm and balance. But, the concept itself was an external elusive thing. At the end of graduate studies, design has finally become internalized, it is everywhere.

Many different types and styles of design have come into view where there once was a void. There are graphic, tight, technical and analytical designs that strictly follow the formal rules. Organic, loose, free flowing intuitive designs also follow the basic rules of design. Designs can be created as part of an impersonal job order, This week, I want floral or lace designs or stripe designs." Or designs can be part of a technical problem,"Can I create a waffle weave from heavy rayon?" or "Can I follow sphere shapes with a weave structure?"

The most demanding and exciting kind of design is intuitive design, "Look at the flower, feel its essence and create a design."

All the same knowledge and technical skills that are required for tight graphics are required but the difference is all that knowledge and skill is placed on the back burner of the mind and intuition takes over. In short, a calculated temporary loss of control, a feeling of flying through space takes over with total trust in intuition to follow all the skills that have built up over the years. It's a big gamble but the results are exciting beyond belief. If there is any one feeling it is the reward for years of striving to create art, this is it! A lifetime of creating and the experience of graduate school has sharpened skills to the point of switching at will from intuitive to analytical modes or a combination of both. Before graduate school this choice of modes was not available due to lack of trust in intuition because of gaps in technical skills. The channels of conscious and unconscious are all finely tuned and working properly. The ability to tune in to the intellect, emotions, sensuality and creativity at will is fantastic. The repression of any one on these channels will definitely affect the others and severely limit creativity.

It takes a great deal of courage to "let go" and to trust your intuition. Constant positive feedback and encouragement causes the apprehension level to lower and this relaxation brings about trust in instincts. More positive feedback brings about more trust in instincts. The knowledge and the ability to create any type of design

from anything is pure joy. But intuitive design will always be the personal favorite. Creating a design from feelings is the ultimate in excitement.

A great gift has been received at graduate school, the channel of creativity has been opened. The answer to the evasive concept of design was so simple. It's everywhere the eye can see. All that was needed was an internal look and trust in feelings and instincts, positive feedback enabled that. Know thyself and be thyself truly are the two rules of life.

Thank you Professor Bujnowski for sharing your internal vision.

CHAPTER 7

THESIS WORK:TECHNIQUE AND PROCESS

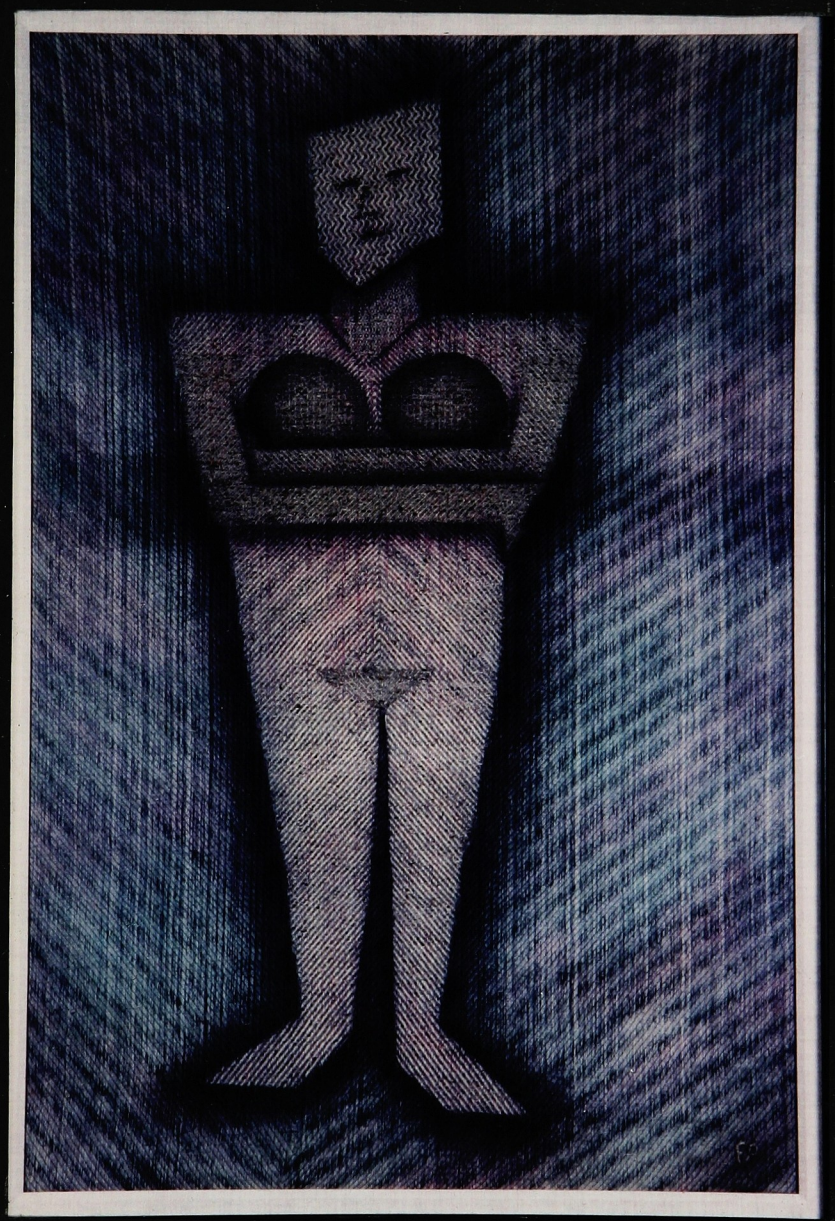


Fig. 24. Figure one,
"Spirituality: Woman Inside, Her Soul"

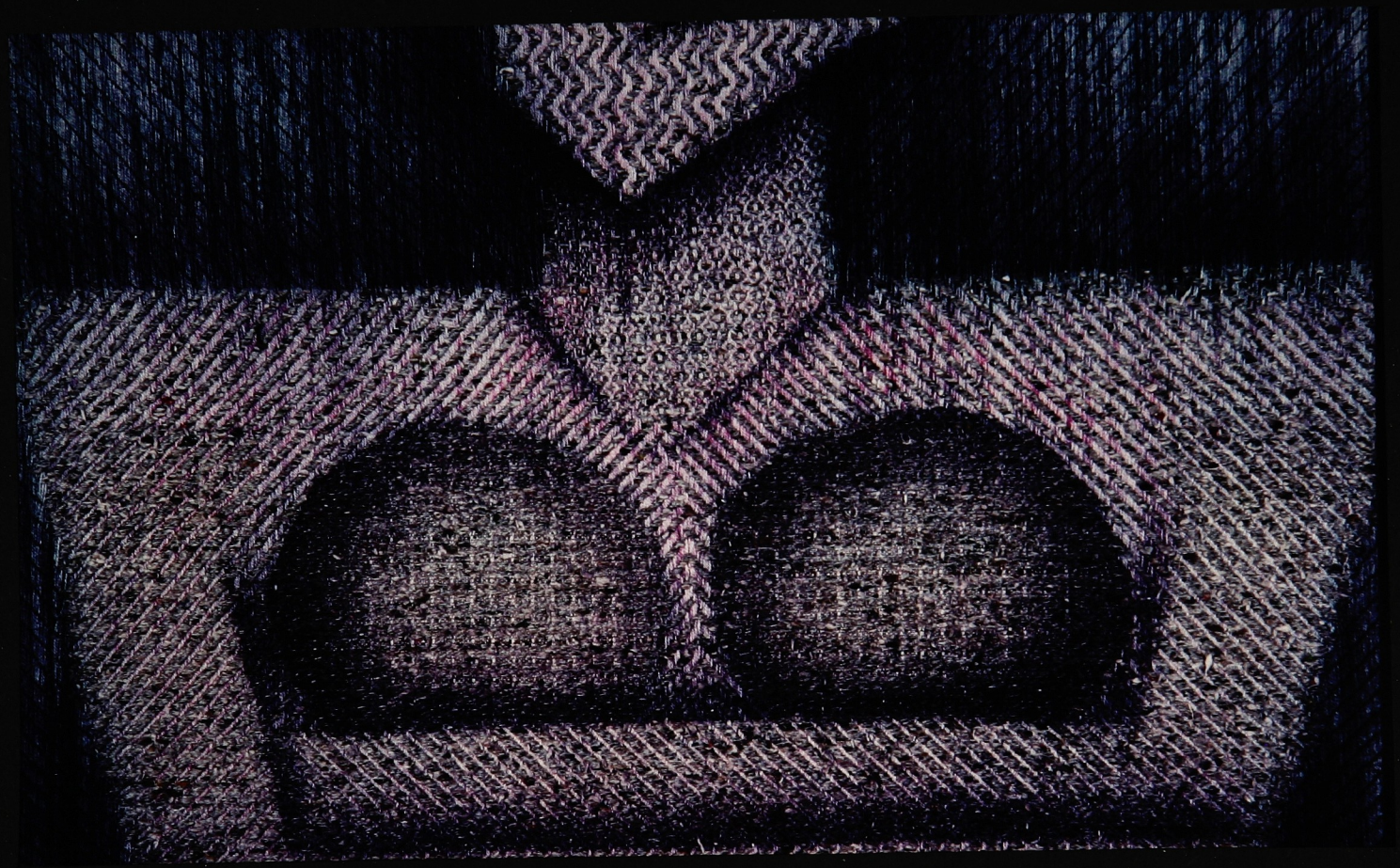


Fig. 25. Figure one,
"Spirituality: Woman Inside, Her Soul"

CHAPTER 7

THESIS WORK:TECHNIQUE AND PROCESS

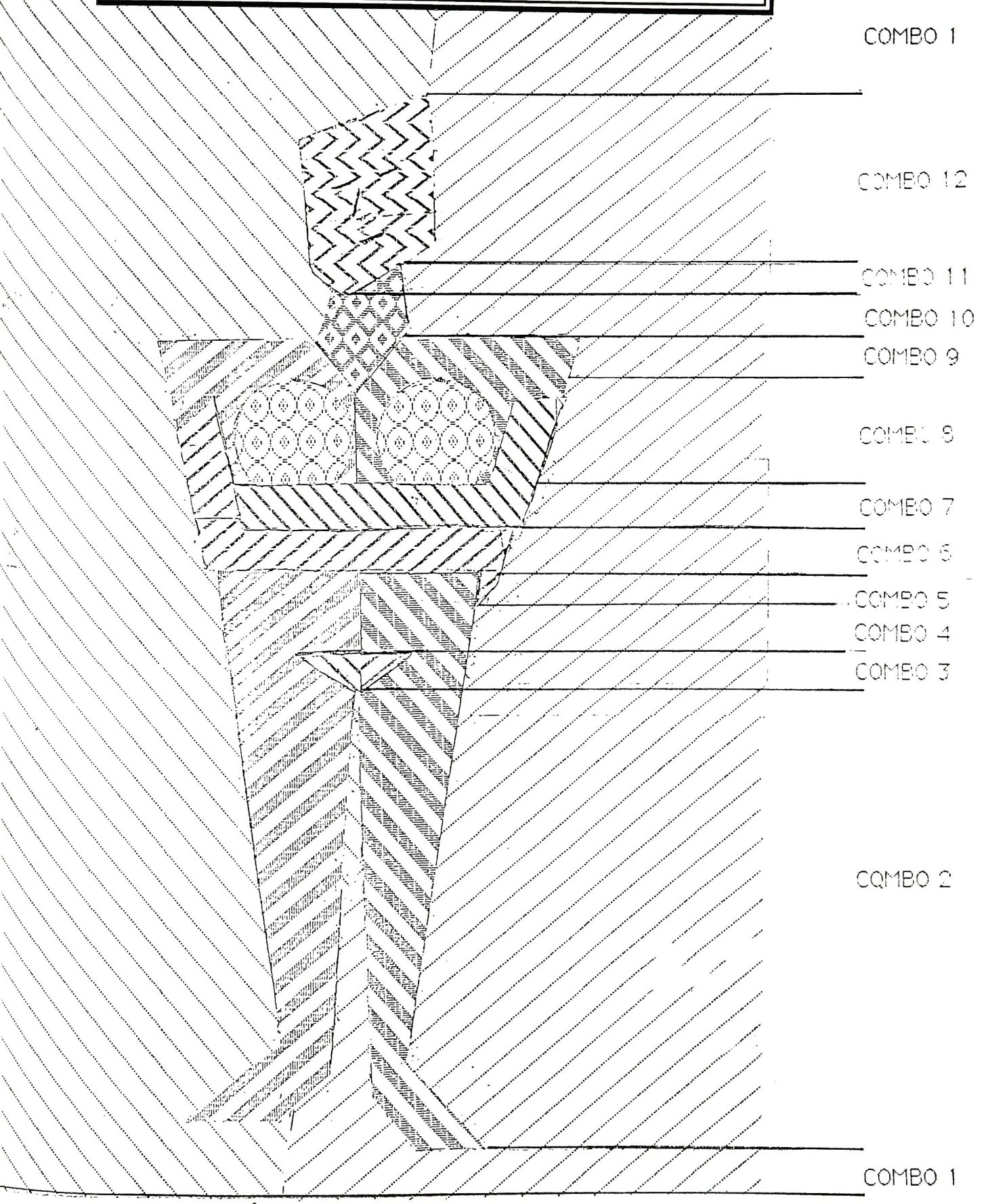
#1 and #2 Spirituality: Woman Inside, Her Soul

Technical goals were high, two figures were designed, the first was meant to be a building block for the second in technical difficulty. The attainment of knowledge, technique and skill were the primary goals in the first two figures. The design was purposely kept simple, the reasons for this were creative and technical.

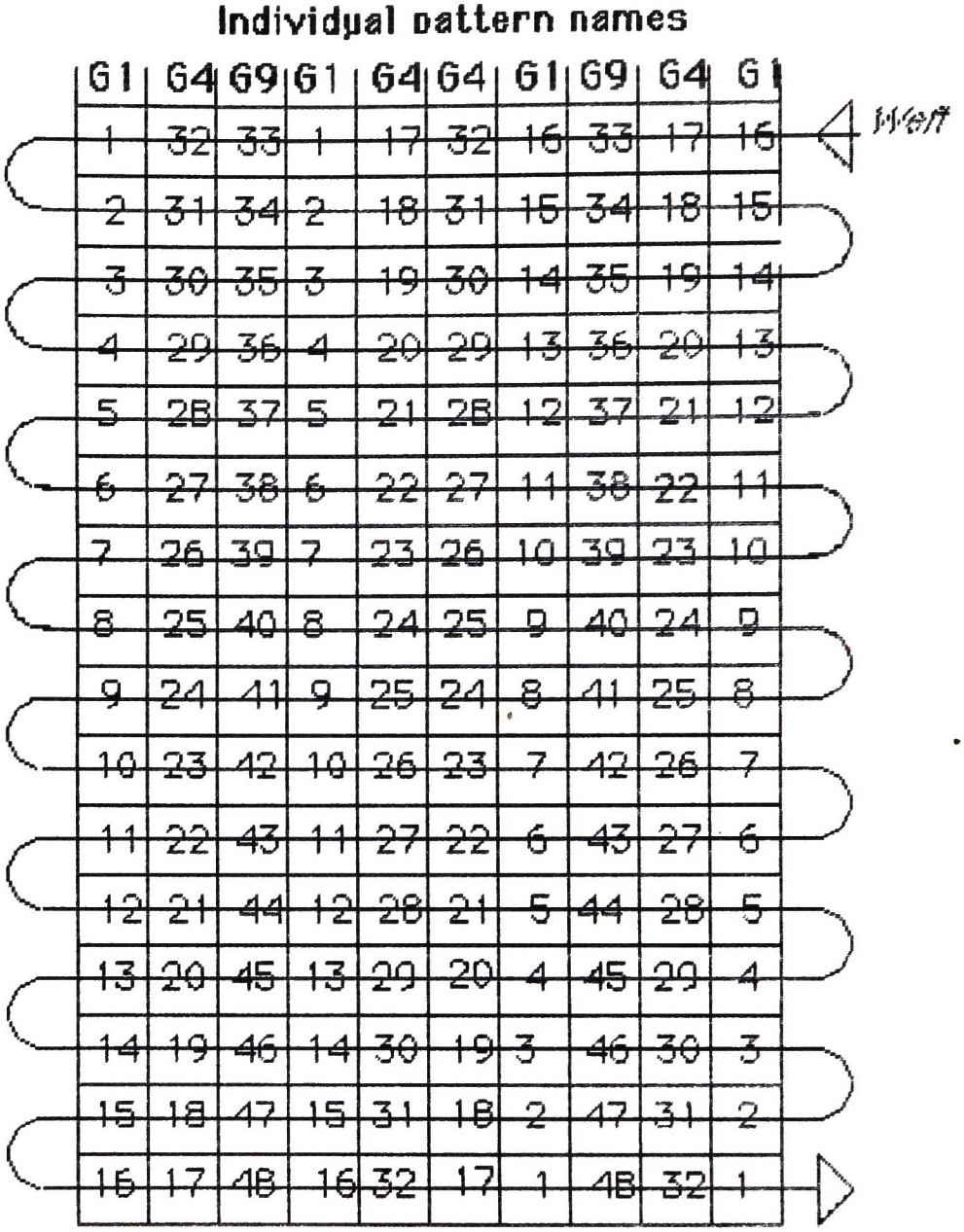
The first figure was angular and all the patterning (Fig. 24.&25.), except for the breast and neck area are twills. The twelve yard warp that was chosen for all five pieces was a tightly twisted natural silk tussah. It performed well for all the pieces and the only problem encountered was due to the fact that four ends were wound on simultaneously and backspin occurred when the warp was pulled forward and out in order to paint each individual piece. Due to this backspin, pulling the warp forward for each piece was a time consuming experience, one of many before the conclusion of this thesis.

Countless hours were spent on the Atari Weavemaster program before weaving ever began. First, the tie-up and treadling sequence for each pattern designed had to be printed out and filed away. This

Fig. 26. Treadling patterns for computer loom



MERGED TREADLING PATTERNS FOR COMPUTER LOOM (FIG. 1)



Combo 3: merged treadling pattern showing weft direction.

Numbers in boxes represent individual tie-up treadles for each pattern

Treadling sequence is manually programed into the computer following weft direction.

Fig. 27. Merged treadling pattern showing weft direction

proved difficult because even with the enhanced Weavemaster disk, a 2 1/2 x 5 inch print out was the only option. This was much to small to make a scaled down version of the structural weave of the figure.

No alternative was left other than to make several print-outs, glue them together and make copies until a 8 1/2 X 11 inch pattern was created. At this point, appropriate parts of the image were traced onto the pattern sheets and glued together to form the figure. This produced a visual concept of the patterning that was chosen for the figure. The next question was how to convey this image into a painted warp. Why not follow the structural patterns in a painted warp? The idea was fascinating, and so the decision was made to go with it.

The next task was to enlarge the small image to 48 X 66 inches and to accomplish this, the Macintosh computer using the Thunderscan and Ready,Set Go programs were used. The small image first was scanned into the Thunderscan program and then moved into the Ready, Set, Go program where it was blown enlarged to 48 X 66 inches. The time element to get a print out on the Laser printer was great. The print out started at 11P.M. and finished at 8:30 A.M.. It was comprised of 64 pages which had to be taped together by matching registration marks in the corners. Before this step was taken, two additional copies of the total image were made.

The warp was now pulled forward up and over the racks as shown in the picture (Fig.28.top). It was held taut at the bottom with clamps, and it solved the problem of working horizontally. The first computer cartoon was now placed behind the warp. From a second cartoon, a stencil of the figure was cut out, and temporarily adhered and positioned on the front of the warp. The structure patterning on the cartoon was with the use of airbrushing (Fig.28.bottom). When the background was completed, the paper stencil covering the figure was removed and the figure was patterned in with the airbrush. Airbrushing was purposely applied done only on one side only to avoid dominating the subtle gray structural patterning from the weft yarns.

After the completion of warp painting, the silk was wound back on the back beam quite easily. But now, another time consuming task began. All the different structural patterns had to be woven simultaneously into one image. The question that presented itself was, how to program these patterns together into the computer? The small image had to be broken up into separate treadling sections as shown in the example (Fig.26.). The treadling sections were named combo 1, combo 2 etc., when filed into the computer. Each treadling section had to have appropriate tie-ups and merged treadling sequences in order to produce the final design. The direction of the

Fig. 28.
Airbrushing figure one on a vertical warp

Fig. 29. Figure two,
"Sprituality: Woman Inside, Her Soul"

twill and the path of the weft thread is extremely important to remember when planning the treadling sequences. The first section was rather easy, one tie-up was used and the treadling sequence was set up so that the warp twill moved to the left on one side and to the right on the other.

Progressively more complicated treadling sequences (Fig.27.) had to be programed into the computer, as the weaving moved up into the legs and body of the figure. Moving from the first to the second section brought the realization that existing patterns must continue on from the point at which they stopped. That also brought on the discovery that only certain treadling sequences could be programed in advance. Some had to be completed when that particular point in the weaving was reached so that instant knowledge of where to pick up the pattern and continue was at hand.

The most difficult patterning section in this piece occurred in the breast and neck area of this piece. All of the previous treadlings merged and were sixteen pedal sequences, but the breast and neck area had a 15 pedal sequence pattern. This created a great deal of work, in order to create a complete cycle at this point, the pattern merged with the sixteen pedal patterns, over 1000 pedals had to be programed in to the computer MANUALLY. Needless to say, the possibility of making a mistake completing this task was great. Each computer system has its good points and its bad points. The

enhanced version of Weavemaster has a merge option but it only merges entire patterns between pedal sequences of other patterns. It is unable to merge treadling patterns simultaneously, following the direction of the weft thread.

As the first figure neared completion, technical difficulties with the computer loom system increased. These difficulties will be focused on later in the troubleshooting chapter.

In spite of the technical problems encountered, this piece turned out extremely close to the envisioned design. A structural image was painted on to the warp and this painted image was followed with appropriate structural patterning. Some errors in weaving were unavoidable due to the limited knowledge of the capabilities of the computer loom itself. There were no written manuals to draw from, it was definitely a learn as you go experience, the pragmatic approach.

Dye-shading was airbrushed onto the completed woven figure just before it was steamed, washed and pressed. The outcome is pleasing, however doubts occurred whether a darker weft material should have been chosen but the subtle patterning gives the figure a mysterious aura. It looks just like a simple figure image when you glance at it from a distance. But it has a quality that draws you up to it , and invites you to examine it more closely. You soon discover as with people, that all is not as it seemed in that first quick

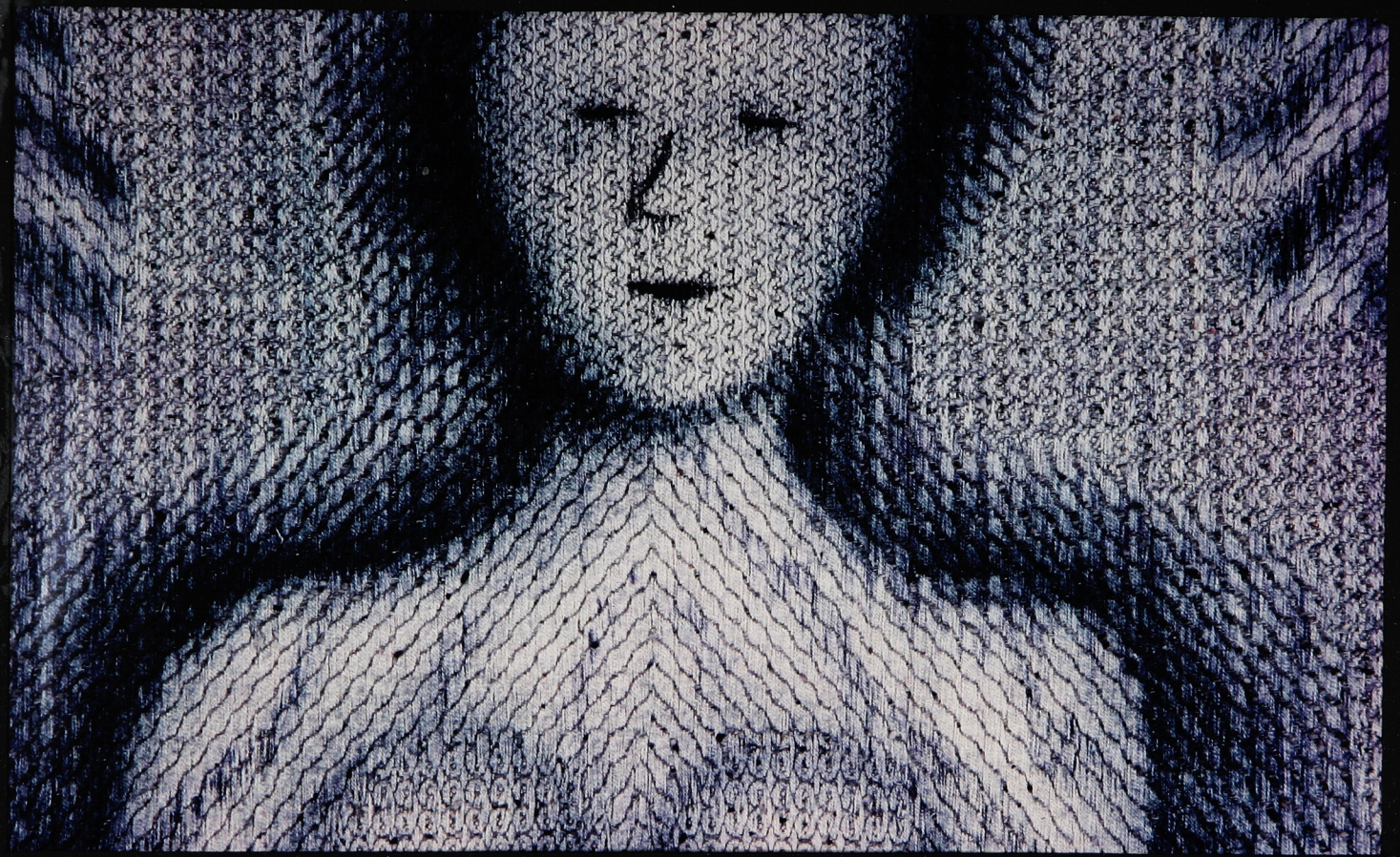
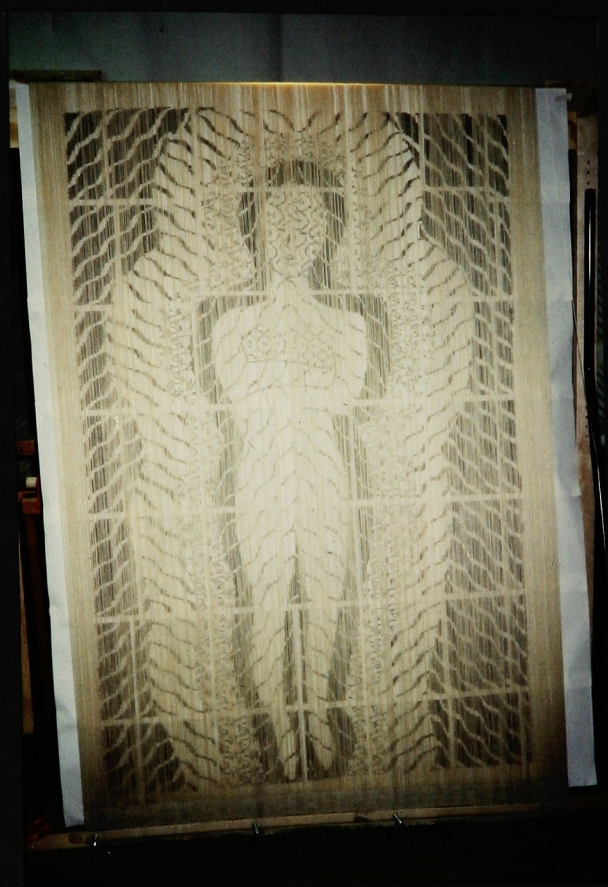
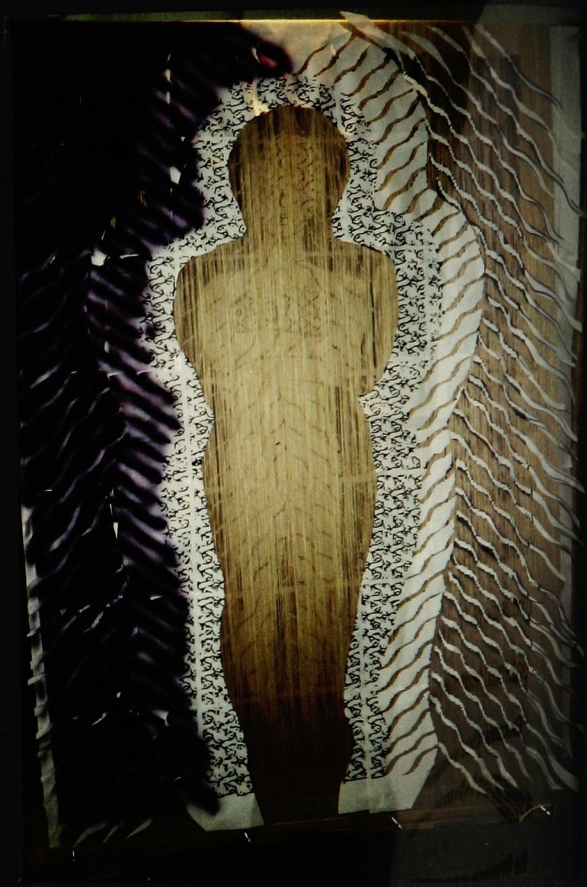


Fig. 30. Figure two,
"Spirituality: Woman Inside, Her Soul"





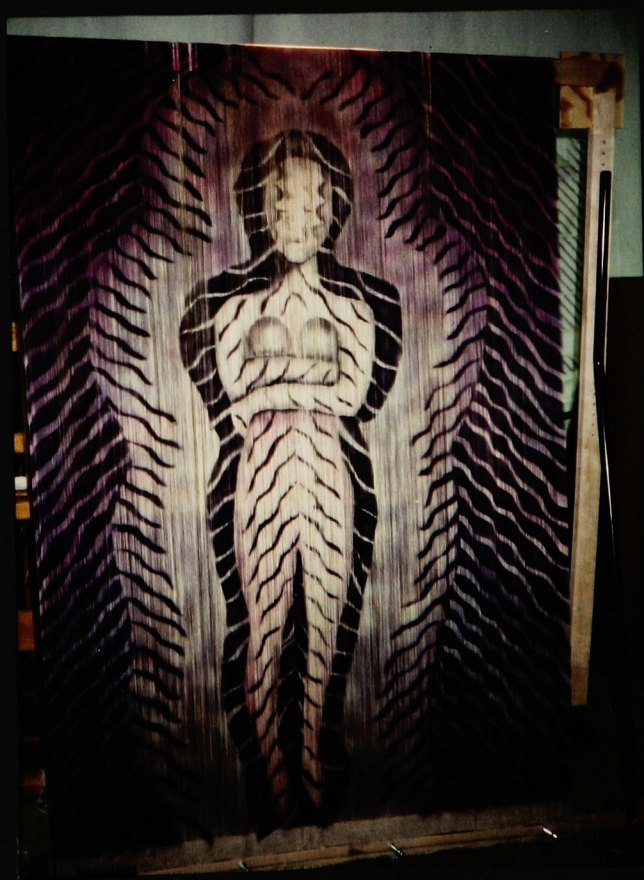
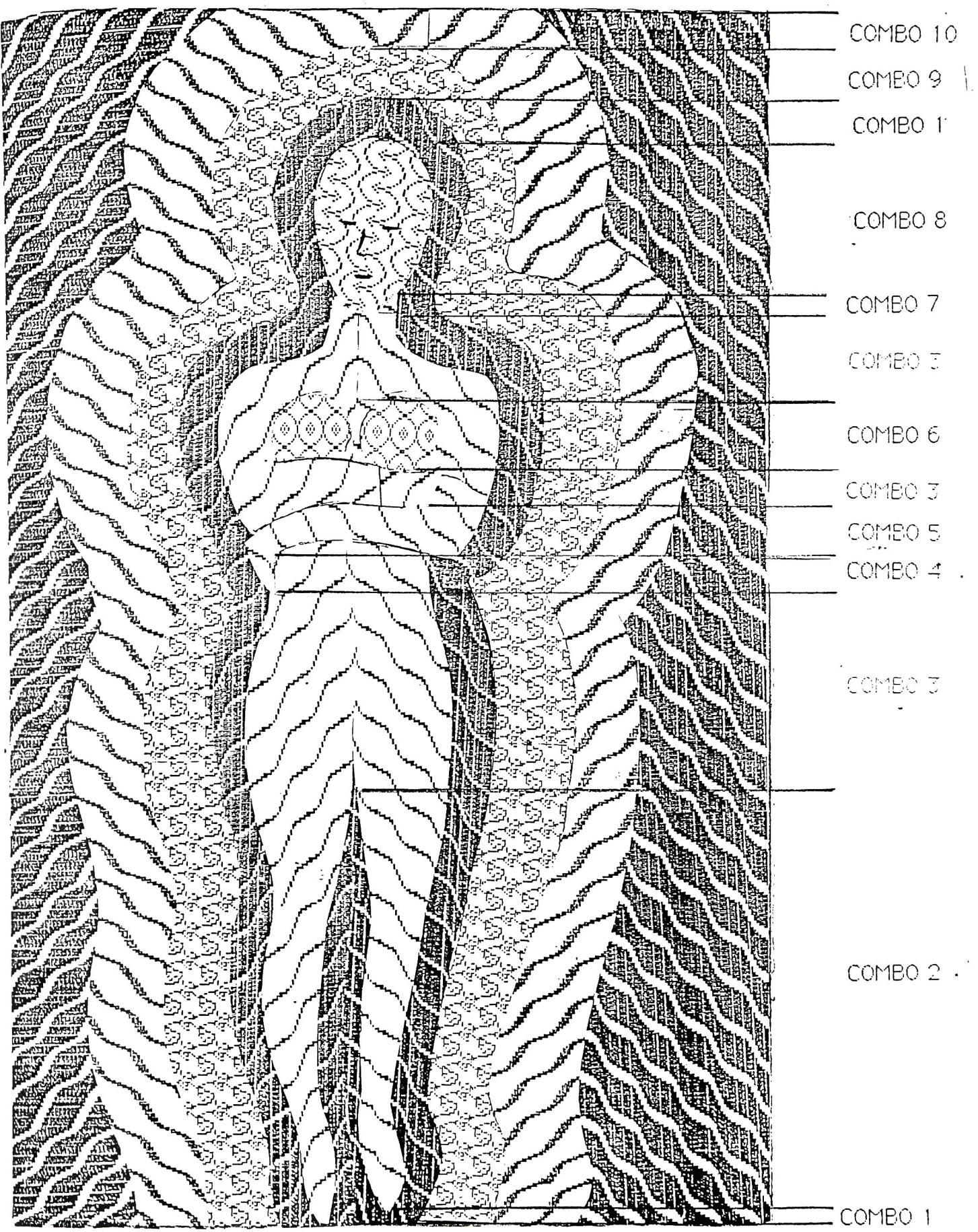


Fig. 31.
Airbrushing
figure two on
vertical warp

surface glance.

The creative goals and imagery for figure two (Fig.30.&31.) were identical to figure one. The only difference was the increased technical difficulty due to the more complicated patterning. Figure two had much more patterning, the shapes were curved and rounded instead of angular and the patterning itself was also curved, an undulating twill (Fig.32.). Changes had to be made in the original patterning because the Weavemaster tie-up is limited to 64 pedals. Because of this fact, only five separate patterns could be woven across the shed at any one time. Due to the increased patterning and the fineness of the weft, the strain on the computer loom led to massive technical problems at this point. The breast area in figure two should be concentrated on to help one realize just how hard the system was working. In this section, (combo 6 in illustration) sheds had to be changed thirteen separate times to complete one individual weft pick. When you figure that it takes about twenty-four weft picks to complete one inch, which comes out to be three hundred twelve shed changes per inch. In addition, most of the shed changes were warp faced, so the pressure on the solenoids lifting the harnesses were tremendous.

This piece was finished in the same manner as the first. It was at this point of the thesis that the computer loom and its capabilities had been researched enough, now it was time to put all



MERGED TREADLING PATTERNS FOR COMPUTER LOOM (FIG. 2)

Fig. 32. Treadling patterns for computer loom

Fig. 33. Shading completed image

this new found knowledge and skill on the back burner with the rest of my technical skills and trust my intuition to bring the correct skills forward at the right time. The computer was now in its proper place, just another tool in the creative process.

"Ecstasy: Merger of Conscious and Subconscious"

In this piece titled "Ecstasy: The Merger Of Conscious and Subconscious," the warp painted imagery was used as a cartoon to weave computer designed weft patterns. The envisioned curved shape of this piece proved to be an engineering challenge. The time element in finishing was the same as painting and weaving it. Because of the shape of the rods, the weight factor and the correct hanging of this piece became a critical factor. Technical problems with the computer loom caused some long floats on the back of the piece. Because of the many different warp-faced harness tie-ups and treadlings, it was difficult to notice if a certain harness was or was not lifting properly until several inches had progressed. Because of these back floats, the decision was made to line the piece, this made it even more difficult to hang correctly. A mistake in finishing was the decision to insert a curved round rod into the piece, a flat rod would have been a much wiser choice. This was corrected by inserting belt backing into the top and bottom. Twelve plastic strips with velcro tabs were then inserted on the back of the piece extending from top to bottom, this gave stability to the piece. At

Fig. 34.
"Ecstasy: Merger of Conscious and Subconscious"

Fig. 35.
"Ecstacy: Merger of Conscious and Subconscious"

this point, metal brackets were designed to fit into the end curves, in order to hang the piece without having it sag in the middle.

Despite the technical problems encountered the actual weaving of this piece went very quickly as compared to the first two. This was due to two factors, the first being that only one background pattern moving in two different directions was used. The second factor was programing weft faced pattern lifts at the end of each pattern shed. This technique allows the weaver to weave many sections at one time. The weft patterning sits on top of the background pattern. Using this technique allowed the weaving to proceed at a much quicker pace and it didn't seem to overtax the computer system.

This piece most definitely presented the greatest challenge in finishing. Perhaps instead of being titled "Ecstasy," it should have been titled " The Agony And The Ecstasy."

Fig. 36. Handpainting horizontal warp

Fig. 37.
Masking and painting strips as weaving progresses

Sensuality: Woman Outside, Her Body

A real creative roll was being experienced by the time work started on "Sensuality: Woman Outside, Her Body," I suppose one might describe the feeling as ecstasy, the merging of conscious and subconscious, which also happens to be the title of the last piece completed, isn't that a coincidence? The challenge to create this piece was presented on a Friday afternoon, and by Saturday afternoon, it was completely conceptualized, all the technical problems to bring it into fruition had been mentally resolved.

The first task was to figure out the finished size of the fabric to be woven. This size was reduced in proper proportion and a small sample of the same type of fabric to be woven was pinned to a wire shaped as the form planned. The wire length for the form was figured to match the fabric sample. Then, a piece of cotton was cut to match the size of the completed woven fabric. It was pinned on to a form made from flexible aluminum rod which was wrapped with cotton strips. With the cloth pinned into place on the form, shapes were drawn on to the cloth with a fabric pen. The cloth was then removed and used as a pattern for two paper cartoons that were

Fig. 38.
"Sensuality: Woman Outside, Her Body"

Fig. 39.
"Sensuality: Woman Outside, Her Body"

made with the help of the light table. This warp was pulled onto the print table to paint. The cartoon was then placed under the warp, (Fig.40.) stencils were cut and temporarily adhered to the top of the warp. The edges were airbrushed and handpainting with a brush and finally a sponge roller was used to complete the painting. The warp wound on the loom fast without any problems, this was a great feeling after all the technical problems experienced up to this point. It was woven, steamed, washed and pressed in a matter of days. The transformation of the woven fabric into a three-deminsional form seemed to happen like magic. One day was all that was needed to complete this transformation. A black mirror base was designed and created to complete this form.

The computer programing and weaving technique were the same as what was described in the last piece. A simple background pattern with weft patterning following the painted shapes. This was a very successful piece.

Fig. 40.
Paper stencil and background painting for "Sensuality"

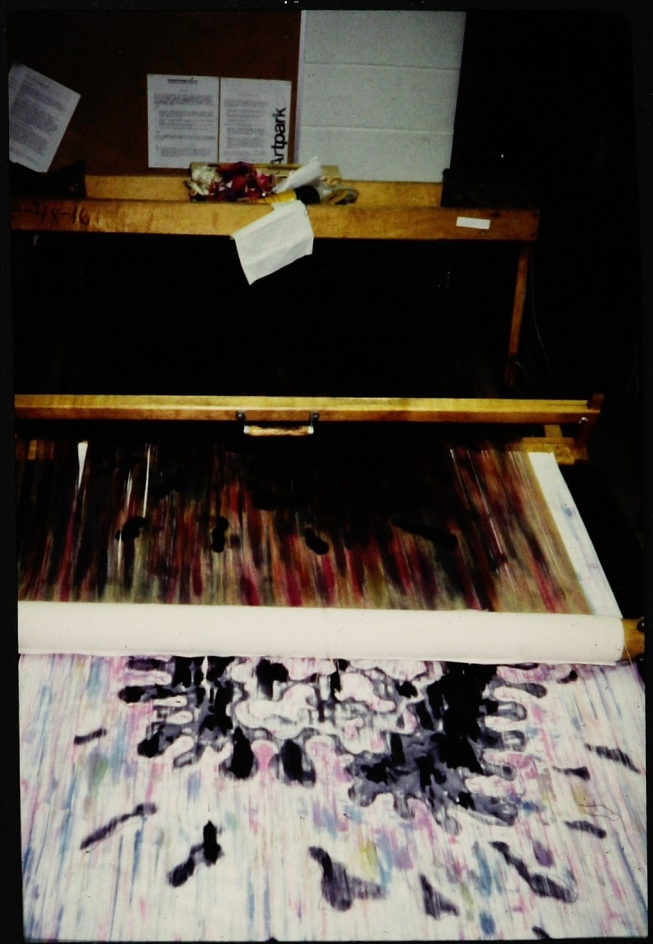


Fig. 41.
Winding the warp on and weaving "Sensuality"

Psychological Breakthrough:
Intellectually, Emotionally, Sensually and Creatively

The last piece, was totally unexpected, you might say it was a gift from the Gods. It provided a fitting completion for this thesis. It is aptly titled "Psychological Breakthrough: Intellectually, Emotionally, Sensually and Creatively."

Extra warp was planned at the beginning of this series to compensate for unexpected mistakes. No problems occurred that necessitated the use of additional warp, so there remained enough warp to create one more piece. This piece represented to the breakthrough of all the limitations, restrictions and repressions we impose upon ourselves and which society imposes upon us from birth. The total freedom to be yourself and to like yourself without guilt or shame. This piece was the quickest of all, it was designed, woven and finished in nine days.

During the finishing process, it was cut into shapes and sewn on to a mylar covered foam core board. It was a really pleasant experience to cut this piece up. It felt fantastic and it totally carried across the theme of the piece. It takes courgage to change a

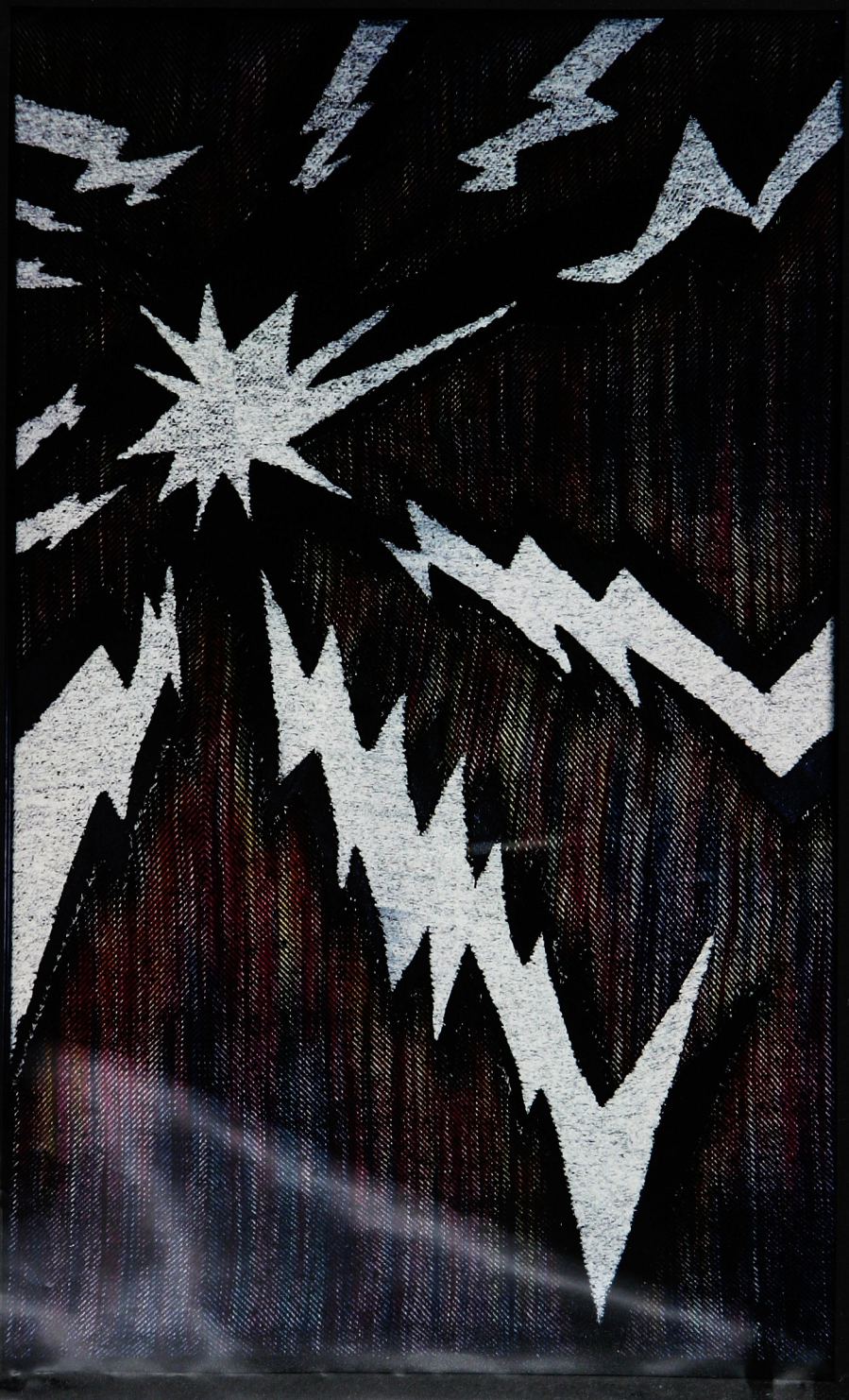


Fig. 42.
"Psychological Breakthrough: Intellectually, Emotionally, Sensuously and Creatively"

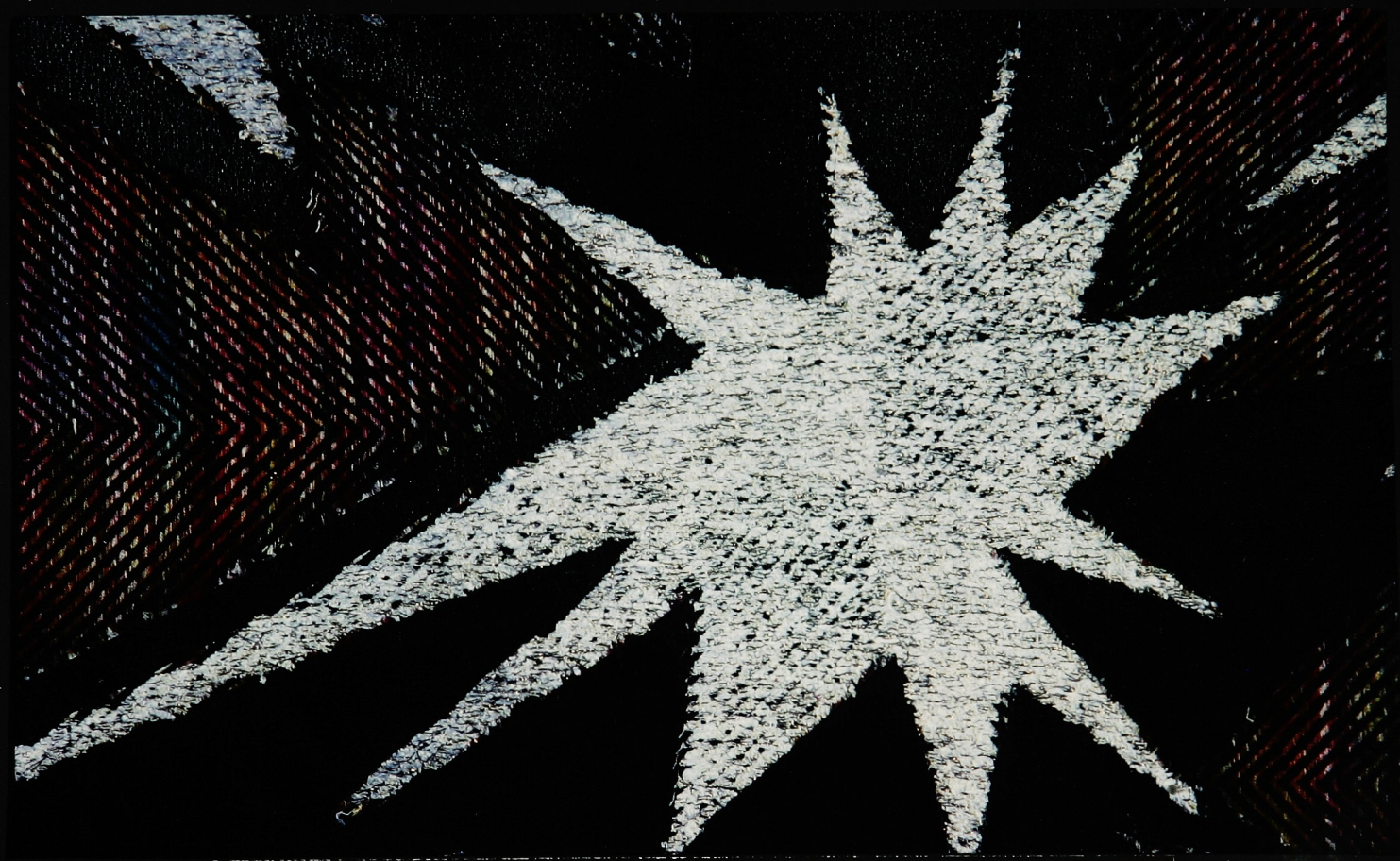


Fig. 43.
"Psychological Breakthrough: Intellectually, Emotionally, Sensuously and Creatively"

way of thinking and behaving that you've always believed in just as it takes courage to cut up a beautiful work of art that you've spent countless hours working on. In either case, the end result is a gamble.

Computer programing of treadling sequences went fast for this piece due not only to simple patterning but to the fact that the pick-up method was being used to avoid excessive treadling changes. Major problems again reoccurred with the solenoids on this piece, they will be detailed later in the troubleshooting chapter.

Fig. 44.
Adjusting the paper stencil and painting the warp for "Breakthrough"

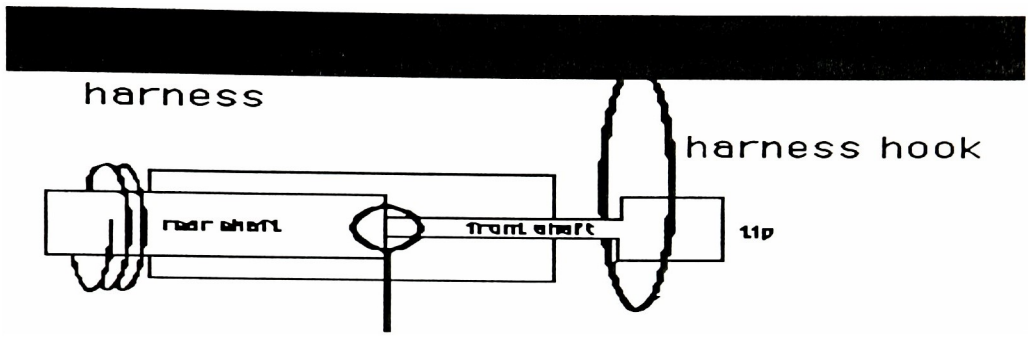
Fig. 45.
Weaving "Breakthrough"

CHAPTER 8.

TROUBLESHOOTING THE ATARI/MACOMBER COMPUTER LOOM

Working on the Atari/Macomber computer loom was a real learn as you go experience. The manual that came with the Weavemaster program was self explanatory, but the actual capabilities and operation of the loom was another story altogether. Up until the weaving had progressed into the second figure, the problems encountered were minor. Harness hooks kept opening until it was explained from a phone conversation with Macomber Looms that crimping of the hooks to keep them in place is of critical importance. It took several treadling errors before this discovery was made.

The next experience was a surface float, which appeared in the piece being woven. Upon closer examination of the tie-up and treadling it was discovered that one harness continually lifted every time. This was caused by the tip of the solenoid shaft being hung up on the harness hook.



spot where shaft broke apart
on solenoid

The basic design of the solenoids is incompatible with any constant, continued use. The only way to remedy this problem is to remove the solenoid and replace it. This also was done with the aid of telephone instructions because there was no printed material to refer to. The solenoid was carefully removed. It ended up having to be replaced because the shaft of the solenoid came apart where it was epoxyed together as shown in the illustration above. This experience occurred at least nine separate times during the course of this thesis. At first it was thought to be as a direct result of the shear amount of warp-faced harness lifts but it was occurring again in the last piece woven. The reason for this could not have been the harness lifts, because they were kept at a minimum in this piece. But the actual weaving in this piece was at a very fast pace and the solenoids just could not take the speed of the weaving. Four solenoid shafts fell apart during the last piece. Twice during this series

solenoids just stopped working for no apparent reason. This was discovered when a long float was noticed on the back of the weaving. Needless to say this was very frustrating to the weaver. Memorization of the harness lifts is impossible when so many patterns are going at one time.

Problems were also experienced with the power unit. Two separate units stopped functioning during the course of this series and the reason for this is not yet known. Special care must be taken by the user to turn on the power unit only after the Weavemaster program is in use and the Designers Delight is connected. It is also equally important that the power unit is shut off before the Weavemaster program is shut off. Failure to do this can result in damage to the unit. This is explained in the manual. Remembering this every time seems to be very incompatible with a student environment.

Changing solenoids was old habit by the end of this thesis. The panel on the pedal is unscrewed and the broken solenoid is first unplugged from the circuitry panel, the wire is then pulled through the hole near the solenoid and the solenoid itself is unscrewed. The new solenoid is screwed into place and the wire is inserted into the hole near the solenoid and plugged into the circuitry board. The top of the pedal is then screwed back into place.

CHAPTER 9.

RESEARCH

Can a computer be an artist's tool? A few short years ago the answer would have been an unqualified NO WAY but technology has dramatically changed thinking in a short time. Computers at first were difficult to learn and the results were crude. But the new technology has brought about more versatile programs, a higher resolution and more color then the eye can possibly see for the artist to create with.

A questionare was sent out to two hundred textile companies and two hundred textile designers. The hesitancy of a few years ago has given way to a general acceptance of computers for designing. A few smart companies and designers have deeply committed themselves to computer technology. As far as textile companies are concerned computers are a necessity in order to stay competitive. they preform every job from designing to production of fabric. The textile companies who are using them are very pleased with the results.

The textile companies appear to be ahead of the designers

when it comes to using computer technology. Judging from the results of the questionare, there still seems to be a hesitancy on the part of the designers to learn to use the computer in a positive way. Many replies mentioned that a computer will never replace a real artist. It is simply another tool to enhance an artists creativity, it gives the artist more choices. What seems to be the problem is the artists hesitancy to take the time to learn the technical skills required to create on the computer. At the rate the technology is advancing - the closed minds will be left in the dust. The choice is simple, jump ahead or fall back in the past.

When you measure the time saved and the tremendous design possibilities that are possible with a computer, there is no comparison. In the twenty-first century, the computer will be thought of as a necessary piece of equipment.

The response to the questionare by the textile companies was very impressive. Out of two hundred inquiries, 40% replied. Many sent informative brochures describing in great detail the computer systems they are presently using. Many offers of additional help if needed came from the textile companies. In general their responses were very positive.

The majority are presently using some sort of computer systems for designing and producing textiles. Many are just switching to computer technology and some have not yet switched to

computers but are interested in discovering more about them. The larger companies such as Spartan, Milliken, Burlington, Kalkstein, and Fieldcrest Cannon are totally committed to computers. The Burlington designer responded that within the next five years 80% of fabric designers will depend on some level of computer-aided design. Fieldcrest Cannon is currently using cad/cam for surface design, bed and bath areas and color placement in woven carpets. They are anxiously awaiting more computer equipment. They feel that computers allow more precision unmatched by handwork and that the designer is freed from repetitive tasks.

The textile companies replies seemed to be divided into three groups. The large well known companies are totally committed to computerizing their design and manufacturing divisions.While the smaller companies are experimenting with the personal computer systems such as Atari/ Macomber or Apple/IBM/Mac/AVL. The third group are still rejecting computers as a necessity to stay competitive.

The designers were less cooperative in returning the questionares. Only about 20% responded. Their main objections to computers are the limitations of getting accurate color reproductions of designs created. In other words, the hard copy. Right now, slides seem to be the best translation. Once the technology for getting accurate color print-outs is developed, there

will be a massive change over to computers.for surface design. Color separation is already possible on personal computers, accurate copies of the design can't be far off.

There seems to be a real reluctance on the part of the designers to take the time investigate and learn the possibilities available with computer use. But as the technology advances and the prices decrease the computer will become a necessary design tool for textile designers. Right now, many designers seem threatened by computers. They fail to realize that as Catherine Crammer commented in her reply,"A computer can only be a tool. A bad designer will continue to be a bad designer with or without a computer but an intelligent, creative individual can only increase production and therefore creative potential with the aid of a CAD system."

As far as structural weave is concerned, the best loom options available are Atari/Macomber and Apple/Mac/IBM/AVL. The Atari/Macomber is a computer interface that can be placed on an existing Macomber loom. Both systems have their good and bad points. The AVL loom system is more versatile with different computers. Surface design can be created on any of these computer systems. All that is needed is a good paint program to create designs on.

The apparel industry is is fast changing over to computerized

equipment because of competition from other countries. A company called CDI has developed a basic 2D system package for $20,000. The 3D system is between $20,000 - $40,000. These systems can design any aspect of a garment and manufacture of that garment. The 3D system produces a digitized image of a mannequin that can be rotated on the screen in order to see all the views. The bottom line is, "If the American apparel industry wants to stay competitive, machine vision and CAD/CAM technologies will have to be embraced even further." [1]

1. Van De Bogart, Willard. April 1989. "The Apparel Industry and Imaging," Advanced Imaging. p. 30 35.

CHAPTER 10
CONCLUSION

A road has been traveled these past two and a half years since the delivery of twelve cartons containing a new AVL computer loom. The boxes sat for weeks and the computer purchased a year before sat in the corner gathering dust. Anxiety welled up at the sight of it all. But a commitment was made with the purchase and it had to be faced regardless of apprehension. Determination to overcome computer fear was definitely the first goal. From the day the loom was unpacked and assembled until today, the experiences have included unbelievable frustration, aggravation, irritation, fascination, joy, happiness, pleasure and excitement. A challenge to discover the limitations of the computer is exciting. How far can it be pushed? Will it be an aggravating or an exciting experience today? Computers are great levelers of the mere humans that operate them. Sometimes everything is mechanically correct and they still don't seem to work. These experiences are referred to as internal temper tantrums. Computer people learn fast to have a sense of humor and not to try to analyze every little kink in the system. Some things defy explanation.

Many systems have been worked on during the course of the last two years. Specific ones such as the Genigraphics and the Artronics are impractical for textile designing. This thesis has merely scratched the surface of the possibilities available with the computer as a tool. Fine art was the desired end product for this thesis. The next goal is to discover the personal computer system that is most practical and versatile for surface and structural designing. Plans are being made to continue research into surface design possibilities for silk screens. This will be followed by more directly focused research into structure design possibilities on the AVL/Apple computer loom. Research will be directed towards the Apple, Macintosh and the IBM computer systems. Hopefully this will lead to the discovery of the ideal personal computer for the fiber/textile artist.

The end goal of these experiments and research is publication of a book titled, "Computer-Aided Structural and Surface Design."

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